

## GOLDSTONE RADAR OBSERVATIONS OF MARS: THE 1986 OPPOSITION

T. W. Thompson, Jet Propulsion Laboratory, Pasadena, CA 91109

Radar echoes from the planet Mars were obtained on 27 S-band (wavelength=12.5 cm) and 2 X-band (wavelength = 3.5 cm) tracks using the Goldstone Solar System Radar. These observations took advantage of the favorable 1986 opposition since the earth-Mars distance was 0.40 AU at opposition (the smallest earth-Mars distance since the 1971 and 1973 oppositions) and radar echo strength is proportional to inverse-fourth-power to the distance to the target. Another equally favorable opposition occurs in 1988; these favorable geometries do not reoccur until the next century.

The coverages of the 1986 Goldstone radar observations are summarized in Table 1 and Figure 1; which show the daily start and end point of each observation. The observations were conducted via the cw-spectra techniques described by Harmon et al. (1982 and 1985). A continuous tone was transmitted at Mars and the radar echo was sampled to obtain a Doppler-spread spectrum. Each received event was separated into polarized (opposite sense circular, OC) and depolarized (same sense circular, SC) periods. Also, a minute or two of noise was recorded in each transmit-receive cycle. The total echo time was the round-trip travel-time which was varied from about seven minutes near opposition to over twelve minutes for last runs in October. Thus, about one-third of the total track was devoted to actual echo recording.

The coverage on Mars as shown in Table 1 started at 8<sup>0</sup> S, travelled toward the equator to 3<sup>0</sup> S during August, and then migrated south to 14<sup>0</sup> S for the last run in October. These are new areas for earth-based radars. The data analysis is just getting underway. However, our volatile real-time spectra displays often showed features similar to those observed by Harmon et al. (1982 and 1985).

There was one successful ranging run on 17 October 1986 (the last track). The ground track for this run was similar to the cw observation of 15 October 1986, the Southern-most track in Figure 1. This ranging run had a resolution of 2 microseconds and should yield surface heights accurate to 300 meters.

### References:

J. K. Harmon, D. B Campbell, and S. J. Ostro (1982), Dual-Polarization Radar Observations of Mars: Tharsis and Environs, Icarus, 52, 171-187.

J. K. Harmon and S. J. Ostro (1985), Mars: Dual-Polarization Radar Observations with Extended Coverage, Icarus, 62, 110-128.

+ DOY	DAY-ID	IUTC	LUTC	+FREQ+				
+ 169	860618	833	1102	S-BAND	+ LON-LAT =	95.	131.	9- 7S
+ 170	860619	1117	1255	S-BAND	+ LON-LAT =	126.	150.	9- 0S
+ 174	860623	633	955	S-BAND	+ LON-LAT =	21.	70.	8-30S
+ 175	860624	619	1225	S-BAND	+ LON-LAT =	8.	98.	8-22S
+ 177	860626	611	1053	S-BAND	+ LON-LAT =	349.	57.	8- 5S
+ 186	860705	946	1148	S-BAND	+ LON-LAT =	321.	351.	6-40S
+ 187	860706	637	1121	S-BAND	+ LON-LAT =	266.	335.	6-31S
+ 195	860714	452	801	S-BAND	+ LON-LAT =	169.	215.	5-16S
+ 196	860715	530	930	S-BAND	+ LON-LAT =	170.	228.	5- 7S
+ 198	860717	430	950	S-BAND	+ LON-LAT =	137.	215.	4-50S
+ 201	860720	429	959	S-BAND	+ LON-LAT =	111.	191.	4-26S
+ 202	860721	434	824	S-BAND	+ LON-LAT =	103.	159.	4-18S
+ 205	860724	410	850	S-BAND	+ LON-LAT =	70.	139.	3-58S
+ 209	860728	346	807	S-BAND	+ LON-LAT =	29.	92.	3-36S
+ 216	860804	319	752	S-BAND	+ LON-LAT =	320.	26.	3-12S
+ 219	860807	302	826	S-BAND	+ LON-LAT =	288.	7.	3- 8S
+ 221	860809	304	727	S-BAND	+ LON-LAT =	271.	335.	3- 8S
+ 228	860816	223	626	S-BAND	+ LON-LAT =	197.	256.	3-21S
+ 237	860825	445	653	S-BAND	+ LON-LAT =	149.	180.	4- 6S
+ 241	860829	139	704	S-BAND	+ LON-LAT =	66.	145.	4-35S
+ 244	860901	303	558	S-BAND	+ LON-LAT =	59.	101.	5- 0S
+ 246	860903	249	634	S-BAND	+ LON-LAT =	37.	92.	5-19S
+ 250	860907	239	630	S-BAND	+ LON-LAT =	357.	53.	5-58S
+ 255	860912	430	627	X-BAND	+ LON-LAT =	337.	5.	6-54S
+ 259	860916	211	643	S-BAND	+ LON-LAT =	265.	331.	7-41S
+ 260	860917	225	626	X-BAND	+ LON-LAT =	259.	318.	7-53S
+ 276	861003	420	523	S-BAND	+ LON-LAT =	135.	150.	11-28S
+ 281	861008	335	600	S-BAND	+ LON-LAT =	76.	111.	12-40S
+ 285	861012	2335	546	S-BAND	+ LON-LAT =	329.	59.	13-50S
+ DOY	DAY-ID	IUTC	LUTC	+FREQ+				

Table 1: Goldstone Radar Observations of Mars: 1986

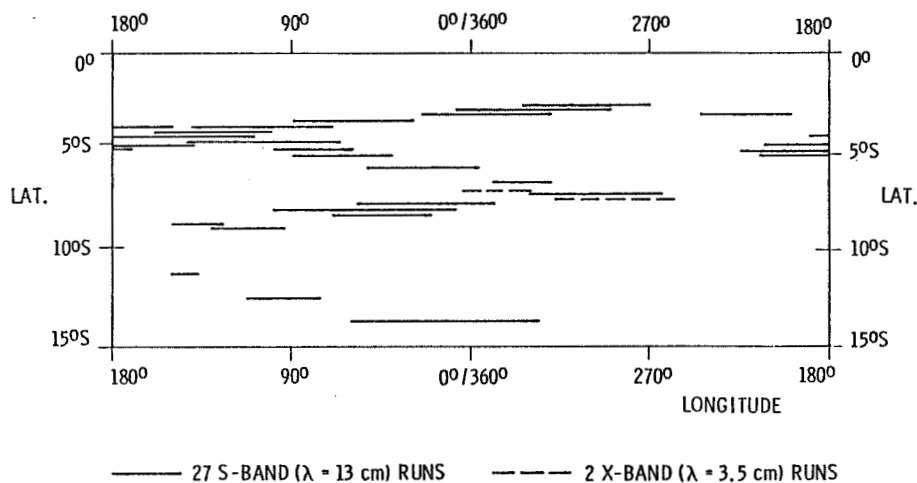


Figure 1: Latitude-Longitude Coverages of 1986 Goldstone Radar Observations of Mars